

Applicant: Xiao Chen  
Serial No.: 09/667,077  
Group Art Unit: 2121

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### IN THE CLAIMS:

Please amend the following claims having the same number as indicated:

1. (Original) A method for providing a simulation of a welding process using integrated models, the integrated models being interconnected by an interconnection tool to determine stresses and distortions of a material being welded, including the steps of:

determining a model of a geometry of the material;

defining a set of coordinates of elements and nodes of the geometry model for a finite element analysis mesh;

delivering the finite element analysis mesh coordinates to a thermal analysis model, the thermal analysis model including an analytical solution model and a finite element analysis model;

determining a thermal analysis of the welding process as a function of at least one of the analytical solution model and the finite element analysis model, the analytical solution model being adapted to provide a thermal history of the welding process for a global distortion analysis, and the finite element analysis model being adapted to provide a thermal history of the welding process for a detailed residual stress analysis;

delivering the thermal history of the welding process to a structural analysis model; and

providing a structural analysis of the welding process as a function of the thermal history.

2. (Original) A method, as set forth in claim 1, wherein providing a thermal history of the welding process for a detailed residual stress analysis includes the step of providing a thermal history of the welding process for a specific portion of the welding process.

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3. (Original) A method, as set forth in claim 1, wherein providing a structural analysis of the welding process includes the step of modeling a set of characteristics of the materials being welded during the welding process.
4. (Original) A method, as set forth in claim 3, wherein characteristics of the materials include residual stresses and distortions.
5. (Original) A method, as set forth in claim 1, wherein determining a thermal analysis of the welding process as a function of the analytical solution model includes the steps of:
- determining a set of adiabatic boundary conditions of the material being welded;
  - determining a set of reflected heat sources as a function of the adiabatic boundary conditions;
  - determining a set of point heat sources as a function of the reflected heat sources; and
  - determining a total analytical solution from superposition of the point heat sources.
6. (Original) A method, as set forth in claim 1, wherein determining a thermal analysis of the welding process as a function of the finite element analysis model includes the step of determining a set of numerical computations of conditions at each desired node and element coordinate of the finite element analysis mesh.
7. (Original) A method, as set forth in claim 1, wherein delivering the thermal history of the welding process to a structural analysis model includes the step of delivering the thermal history by way of an interface module.
8. (Original) An apparatus for providing a simulation of a welding process using integrated models, the integrated models being interconnected by an

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interconnection tool to determine the stresses and distortions of a material being welded, comprising:

a geometry modeler adapted to determine a model of a geometry of the material;

a meshing tool adapted to define a set of coordinates of elements and nodes of the geometry model for a finite element analysis mesh;

a thermal analysis model adapted to receive the finite element analysis mesh, determine a thermal analysis of the welding process, and responsively provide a thermal history of the welding process, wherein the thermal analysis model includes:

an analytical solution model adapted to provide a thermal history of the welding process for a global distortion analysis; and

a finite element of analysis model adapted to provide a thermal history of the welding process for a detailed residual stress analysis; and

a structural analysis model adapted to provide a structural analysis of the welding process as a function of the thermal history.

9. (Original) An apparatus, as set forth in claim 8, wherein the interconnection tool is a graphical user interface.

10. (Currently Amended) A method for determining a thermal analysis of a welding process as a function of an analytical solution model for use in a simulation of a welding process, including the steps of:

determining a set of adiabatic boundary conditions of a material being welded;

determining a set of reflected heat sources as a function of the adiabatic boundary conditions;

determining a set of point heat sources as a function of the reflected heat sources; and,

determining a total analytical solution from superposition of the point heat sources;

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determining a thermal analysis of the welding process as the total analytical solution and one of an analytical solution model or a finite element analysis model, the analytical solution model being adapted to provide a thermal history of the welding process for a global distortion analysis, and the finite element analysis model being adapted to provide a thermal history of the welding process for a detailed residual stress analysis;

delivering the thermal history of the welding process to a structural analysis model; and

providing the structural analysis of the welding process as a function of the thermal history.